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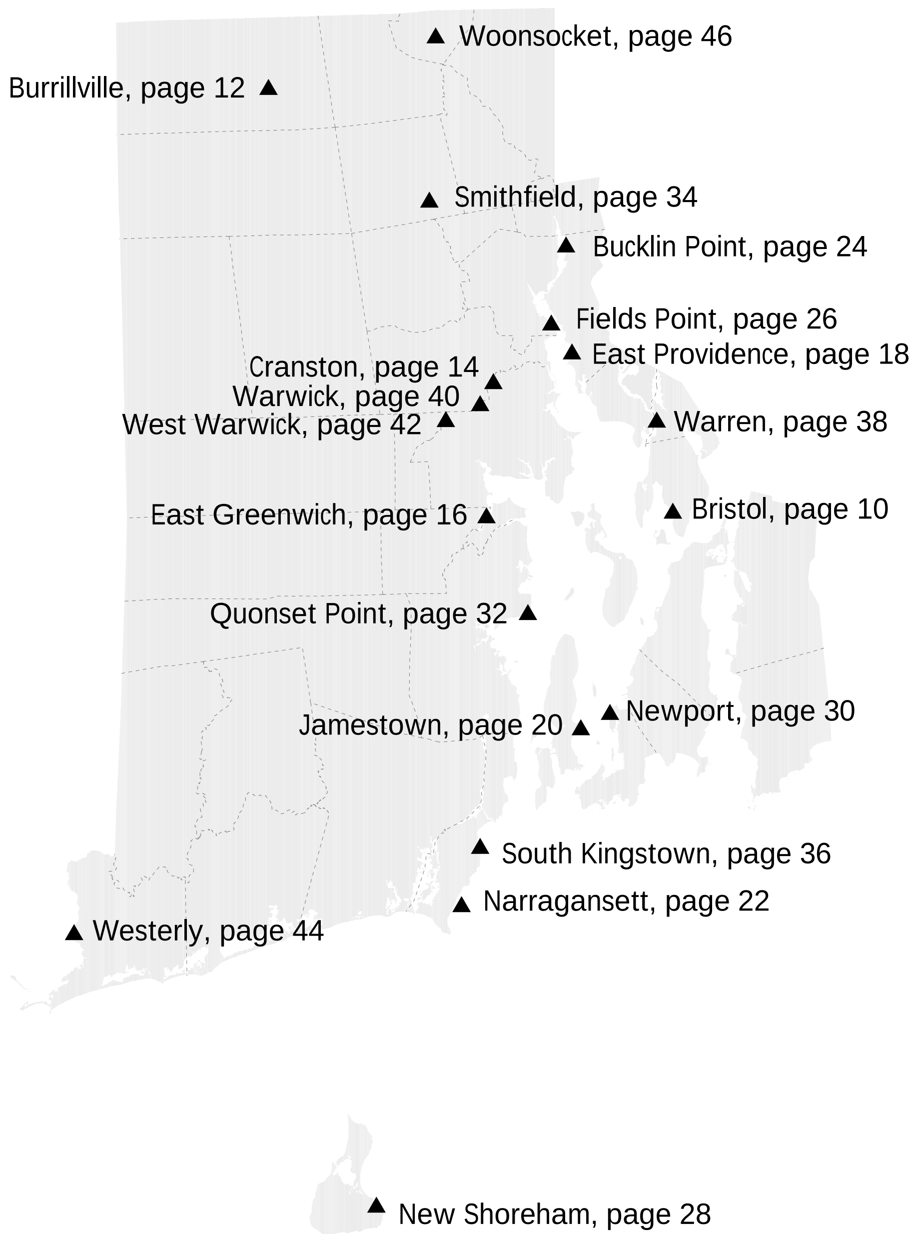

ACKNOWLEDGEMENTS

This year's report is vastly expanded and improved over previous years. We've added new and more information, photos, and graphics in an attempt to better inform you, the reader, about the status of some very important pieces of environmental infrastructure.

What follows is the result of hard work by many individuals. I'd like to thank them for their efforts in making this document a reality.

To my own staff: Ben Lovesky and Alex Pinto, for compiling and sifting through reams of data. Alex also gets special mention for taking many of the aerial photographs of the wastewater treatment facilities. (And while we're mentioning those pictures, thanks to Al Moder, the state pilot who diligently flew Alex over the state in one day.) Thanks also to Judy Cicillini, of our administrative staff, for her help throughout the development of this report. And of course, thanks to my supervisor, Warren Towne, for his support and guidance.

The Office of Water Resources Permit staff were, as always, an invaluable resource and help. Engineers Jennifer Vickers, Joe Haberek, David Cluley and Margarita Chatterton all gladly provided their time, help and expertise. Special thanks to Lori Lombardi-Burns and Aaron Mello for acquiring and deciphering complicated data from the United States Environmental Protection Agency about facility violations. Jack Birchell, of the Permitting Program, provided all the graphs used in this report in record time. A thank you also goes to Eric Beck, the WWTF Permit Staff supervisor who helped coordinate all this work.

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I would also like to thank the state's wastewater superintendents who provided a great deal of input and suggestions about the report: Anthony Silva of Bristol, John Martin of Burrillville, Christian Bratina of Cranston, Joe Macari of East Greenwich, Tom White of East Providence, Glenn Hunter of Jamestown, Doug Nettleton of Narragansett, John Oately of NBC-Bucklin Point, Carmine Goneconte, Paul Desrosiers and Paul Nordstrom of NBC-Fields Point, Grant Weaver of Newport, Joe Shea of New Shoreham, Dennis Colberg of Quonset Point, Al Waitt of Smithfield, Bernie Bishop of South Kingstown, Dave Komeiga of Warren, Joel Burke of Warwick, Mick Pacillo of Westerly, Mike Roberts of West Warwick, and Roger Boltrushek of Woonsocket.

Lastly, and most importantly, thanks to Anne Jett, the office's graphics artist who (as always) managed to turn vague ideas and detailed scientific information into an attractive and easy-to-read document. Anne also assisted Alex in photographing the state's wastewater facilities.

To all of the above, please accept my sincere thanks.

Bill Patenaude, report author
Principal Engineer
RIDEM Office of Water Resources

INTRODUCTION

Rhode Island's wastewater treatment facilities have one crucial job: collecting over 100 million gallons of used and polluted water every day and purifying it before it finds its way back into our rivers, lakes or bays. Wastewater facilities operate all day, every day of the year and are regulated in Rhode Island by the Department of Environmental Management's (DEM) Office of Water Resources, which issues discharge permits and regularly inspects each facility.

One requirement of all discharge permits is the submittal of monthly data regarding the facility's performance. In March of this year the Office of Water Resources reviewed the 1998 and 1999 discharge monitoring report data submitted by the state's nineteen municipal wastewater treatment facilities (WWTFs). This report is based on that review. As in the past, the report evaluates the amount of flow treated and those major pollutants which wastewater facilities were designed to remove and have in common: Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), and fecal coliform bacteria. A plant's final effluent chlorine residual is also discussed. It should be noted that many other pollutants are monitored and/or limited as part of a wastewater facility's discharge permit. While the listing of violations in the survey tables is limited to specific pollutants and refers mostly to monthly violations, there could have been daily or weekly violations for these and other forms of pollution. Although not listed, those other violations were reviewed and considered as part of the plant's overall treatment rating. In many instances, plants are now reconstructing or expanding their facilities as overseen by RIDEM so that they can handle more flow or meet stricter permit limitations necessary to mitigate water quality impacts. Therefore, even though a facility may be rated "Good "or "Excellent, " significant treatment modifications may be required to meet future permit limits.

Before continuing along, it may be helpful to review some of the terms used within the wastewater treatment profession, terms that are likewise used in this report.

DEFINITION OF TERMS

Biochemical Oxygen Demand (BOD) is defined as the amount of oxygen required by bacteria for the biological decomposition of organic matter. A simplified way of thinking about BOD is as the organic "strength" of a water sample. BOD determination is a laboratory analysis that measures a sample's dissolved oxygen before and after a five-day incubation period. The BOD can then be calculated from the change in oxygen levels. BOD was developed in England in the nineteenth century and today it's a worldwide standard.

Chlorine Residual is the amount of chlorine compounds remaining in water at the end of a specified contact period. Because chlorine is added for disinfection before the treated wastewater is discharged back to nature, this parameter is monitored to determine if both sufficient disinfection has occurred without adding excessive amounts of chlorine (a known toxin) into the environment.

Fecal Coliform Bacteria is a group of bacteria that inhabit the intestines of warm-blooded animals. Fecal coliform bacteria counts are used to indicate the possible presence of pathogenic (disease-causing) organisms.

Total Suspended Solids (TSS) is the visible and suspended matter in water. It is determined as the weight of matter that remains on a filter when dried between 103°C to 105°C.

Lbs./day (Pounds per day.) This term is used when discussing total loadings, which is related to concentration (see mg/l below) and total flow.

Million gallons per day (MGD). This is the standard unit of flow in wastewater treatment.

Milligrams per liter. This term is used when discussing a sample's concentration of a particular pollutant. A mg/L is the same as one part in a million.

mls is the abbreviation for Milliliters.

MPN is the abbreviation for "Most Probable Number," which is a statistical term used for measuring Fecal Coliform.

HOW WASTEWATER FACILITIES WORK

Wastewater treatment facilities have been widely used in America since the beginning of this century. (In fact, Providence was one of the first cities in the United States to build a citywide sewage collection system and the third in the country to build a wastewater facility.) All wastewater collected in a service area is piped to a wastewater facility, where various equipment and tanks successively treat the water so that the final effluent meets, or is below, state and federal pollution discharge requirements.

FIRST: The incoming wastewater undergoes a series of physical treatment processes that remove most of the floatable and settleable materials. This stage is divided into the preliminary treatment and the primary treatment stage, and before Congress passed the Clean Water Act in 1972, many facilities provided only these types of treatment.

SECOND: Following primary treatment is a complex biological process, called secondary treatment, which mimics the natural breakdown of wastes in nature. This process provides a mixed, oxygen-rich environment to encourage certain types of bacteria to grow and group together. Secondary treatment converts suspended solids and organic matter into something called a biological floc. Following mixing, the wastewater flows to a settling zone in which the now-grouped-together bacteria — the biological floc — easily settles out, leaving clean water above.

THIRD: The treated water is disinfected, usually with chlorine, and is then discharged into a receiving water. Other processes occur within a wastewater facility which collect and treat the removed pollutants, commonly referred to as sludge. Additional processes may provide further treatment of the wastewater. This is referred to as tertiary treatment.

AND FINALLY: Using in-house laboratories, wastewater facilities monitor and measure the efficiency of their process and the quality of the final effluent on a daily basis.

OVERVIEW OF CONTENTS

As readers examine the statewide trends of pollutants over the past 10 years, a drop of pollutant loadings will be seen for every year except the last two. While higher flows in 1998 (due to excessive rains) contributed to the increase in loadings, both that year and 1999 showed an increase in the statewide total amount of conventional pollutants. For the state's largest plants (which are the biggest loading contributors) the reasons for the increases, particularly in 1999, appear to be related to process decisions to control other pollutants as well as some temporary construction-related reductions in treatment efficiency.

The first section of this report is a two-page comparison of the major parameters: flow, BOD and TSS. This allows the reader to determine the relation between various facilities in Rhode Island. Next in the report are the individual summaries for each community. Each summary contains a brief overview of the facility, a narrative of the facility's performance, a section on current and future permit issues, and, if applicable, any problems which impacted performance. Operations and Maintenance summaries and sludge disposal data are also reported. A table comparing 1998 and 1999 data to 1996 and 1997 data also provides a listing of monthly permit limitation violations for flow, BOD, TSS and fecal coliform. Because not all facilities have monthly limits for chlorine residual, the table of violations looks at only daily maximum data for that parameter. The facility's rating and a performance summary appear below the general facility information and plant photo. On the left handside of the plant summary is a graph showing the monthly average flow, BOD and TSS for 1998 and 1999. On the opposite page is a graph showing the annual average for flow and pounds of BOD and TSS from 1986-1999.

Plants are ranked for treatment based on the number of violations for monthly averages for BOD, TSS, fecal coliform and flow over the two-year period of 1998 and 1999. The ranking is reduced (for example, from Good to Fair) if there are a significant number of violations for BOD and TSS daily maximum limits. The ranking was further reduced if the facility had numerous violations of other permit limits.

A facility's Operations and Maintenance is ranked based on numerical ratings issued during inspections of the plant and the quality assurance/control of the plant's laboratory.

RELATIVE LOADINGS

To keep things in perspective, the following three sets of pie charts show the relative amounts of loadings from each facility for flow, BOD and TSS. The term *loading* is used to describe the total amount of a parameter discharged during a specific period of time. In the case of this report, the time periods are the 1998 and 1999 calendar years.

Pollutants are normally measured by determining their concentration in a laboratory. The results of these tests are often described in units of *milligrams per liter* (mg/L), which is a scientific measurement of "one part in a million." But just knowing how many milligrams of a pollutant are discharged in every liter of water doesn't tell the whole story. It's important to also know the total amount of a pollutant from a facility's discharge — and a wastewater facility's discharge is measured not in liters per day, but in *millions of gallons per day*.

That means that loadings must be calculated by not only testing for a pollutant's concentration, but by measuring a facility's flow as well. For those who are interested, the final equation is:

LOADING = {CONCENTRATION} x {FLOW} x {8.34, a Conversion Factor}

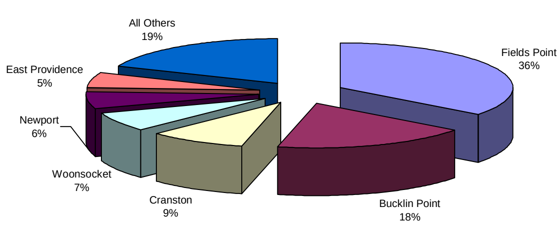
From this equation, we can see that a change in either concentration or flow will increase or decrease loadings accordingly. The graphs below show the relative amounts of flow discharged from individual facilities for 1998 and 1999 combined. As would be expected, those facilities serving larger populations have larger flows.

The graphs on the next page show the resulting annual loadings (also in percentages) for BOD and TSS, based on the flow and the annual average of concentrations for individual facilities. Note that a larger flow does not necessarily result in a larger loading. For instance, while Cranston treated 9% of the state's total flow in 1999 (the third largest amount of flow for that year), it accounted for only 5% of TSS loadings (coming in fifth) and even less than that for BOD.

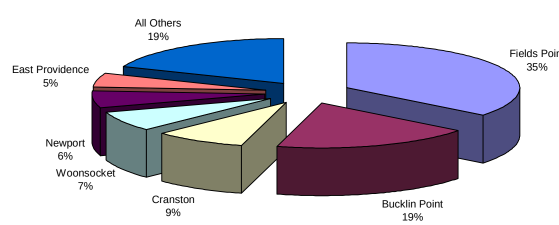
This discussion is very important this year because of the increase in loadings over the reporting period. For 1998, higher than normal flows resulted in higher loadings. In 1999, the flows were back to more normal levels, but relatively small increases in concentrations from the larger plants resulted again in higher loadings over previous years.

1998 and 1999 Flow per Day Comparisons

FLOW PER DAY - 1998

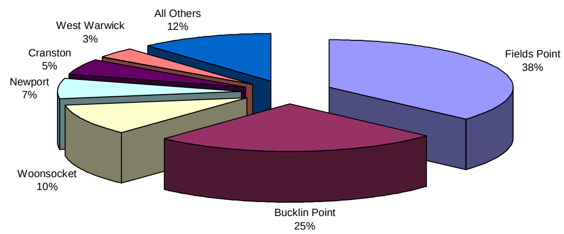


FLOW PER DAY - 1999

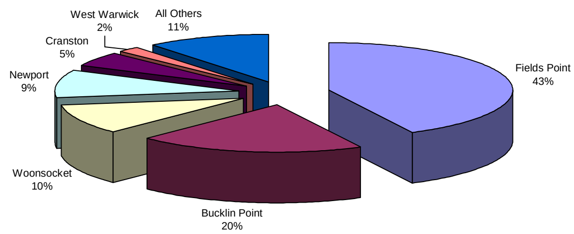


1998 and 1999 TSS Comparisons

TSS PER DAY - 1998

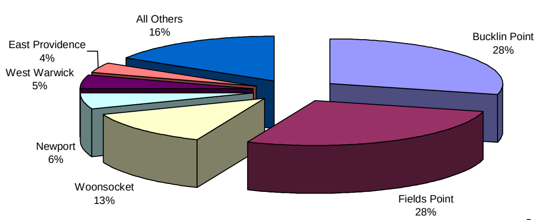


TSS PER DAY - 1999

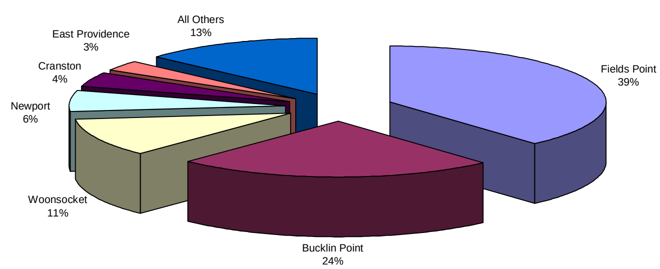


1998 and 1999 BOD Comparisons

BOD PER DAY- 1998



BOD PER DAY - 1999



Anyone with questions about this report is encouraged to call DEM at 222-4700.
Ask for the Office of Water Resources' Operations and Maintenance Section.